

WHAT IS CLAIMED IS:

- 1 1. An apparatus for monitoring the functionality of an optical element comprising:
2 a detector; and
3 a light source whose radiation is reflected to the detector by a surface of the optical
4 element facing the detector and the light source.

- 1 2. The apparatus of claim 1, wherein the light source is arranged to direct radiation to
2 the center of the surface of the optical element.

- 1 3. The apparatus of claim 1, wherein the light source and the detector are disposed
2 laterally to the optical element.

- 1 4. The apparatus of claim 1, wherein the light source and the detector are both disposed
2 at the same angle to the surface of the optical element.

- 1 5. The apparatus of claim 1, wherein the radiation of the light source is directed to the
2 surface of the optical element at an angle of less than 30°.

- 1 6. The apparatus of claim 1, wherein the light source and the detector are integrated in a
2 holder for the optical element.

- 1 7. The apparatus of claim 1, wherein the light source is a light emitting diode and the
2 detector is a photodiode.

- 1 8. The apparatus of claim 1, further comprising a comparator for comparing a detected
2 light intensity detected by the detector with a reference intensity.

- 1 9. The apparatus of claim 8, wherein the comparator generates an error signal when the
2 detected light intensity differs from the reference intensity by a defined value.

- 1 10. The apparatus of claim 1, wherein the optical element comprises zinc selenide.

- 1 11. The apparatus of claim 1, wherein the optical element comprises gallium arsenide.
- 1 12. The apparatus of claim 1, wherein the optical element comprises diamond.
- 1 13. An apparatus for monitoring the functionality of an optical element comprising:
 - 2 a detector; and
 - 3 a light source whose radiation is reflected by a surface of the optical element to the
 - 4 detector, wherein the surface faces the detector and the light source, wherein the radiation of
 - 5 the light source is directed to the center of the surface of the optical element, wherein the
 - 6 light source and the detector are disposed laterally to the optical element, wherein the light
 - 7 source and the detector are disposed at the same angle to the surface of the optical element,
 - 8 and wherein the radiation of the light source is directed to the surface of the optical element
 - 9 at an angle of less than 30°; and
 - 10 a comparator for comparing a light intensity detected by the detector with a reference
 - 11 intensity and for generating an error signal when the detected light intensity differs from the
 - 12 reference intensity by a defined value.
- 1 14. A laser comprising:
 - 2 an optical element;
 - 3 a detector;
 - 4 a light source whose radiation is reflected by a surface of the optical element facing
 - 5 the detector and the light source to the detector, wherein the light source and the detector are
 - 6 arranged to monitor the functionality of the optical element.
- 1 15. The laser of claim 14, wherein the laser is a CO₂ laser.
- 1 16. The laser of claim 14, wherein the surface is a mirror surface provided in a laser
- 2 resonator.
- 1 17. The laser of claim 16, further comprising a laser resonator, wherein the surface is an
- 2 inner side of an output coupler mirror facing the laser resonator.

1 18. The laser of claim 16, wherein the surface is an outer side of an output coupler mirror
2 facing away from the laser resonator.

1 19. The laser of claim 14, further comprising a comparator for comparing a light
2 intensity detected by the detector with a reference intensity and generating an error signal
3 when the detected light intensity differs from the reference intensity by a defined value.

1 20. The laser of claim 19, wherein the error signal causes the laser to be switched off.

1 21. The laser of claim 14, wherein the radiation of the light source is directed to the
2 center of the surface of the optical element.

1 22. The laser of claim 14, wherein the light source and the detector are disposed laterally
2 to the optical element.

1 23. The laser of claim 14, wherein the light source and the detector are disposed at the
2 same angle to the surface of the optical element.

1 24. The laser of claim 14, wherein the radiation of the light source is directed to the
2 surface of the optical element at an angle of less than 30°.

1 25. The laser of claim 14, wherein the optical element comprises zinc selenide.

1 26. The laser of claim 14, wherein the optical element comprises gallium arsenide.

1 27. The laser of claim 14, wherein the optical element comprises diamond.

1 28. An apparatus for monitoring damage to an optical element of a laser resonator
2 comprising:
3 a light source whose radiation is reflected by a surface of the optical element;
4 a detector for detecting radiation emitted from the light source and reflected by the

5 surface of the optical element, wherein the detector is adapted for detecting a characteristic of
6 the reflected radiation indicative of damage to the optical element.

1 29. The apparatus of claim 28, wherein the radiation of the light source is directed to the
2 surface of the optical element at an angle of greater than 60° to the normal of the surface of
3 the optical element.

1 30. The apparatus of claim 28, wherein the light source and the detector are integrated in
2 a holder for the optical element.

1 31. The apparatus of claim 28, wherein the light source is a light emitting diode and the
2 detector is a photodiode.

1 32. The apparatus of claim 28, wherein the characteristic of the reflected radiation is an
2 intensity of the reflected radiation, and further comprising a comparator for comparing the
3 intensity of the reflected radiation with a reference intensity.

1 33. The apparatus of claim 32, wherein the comparator generates an error signal when
2 the light intensity of the reflected radiation differs from the reference intensity by a defined
3 value.

1 34. The apparatus of claim 33, wherein the error signal is used to switch off a laser
2 whose optical element is monitored by the apparatus.

1 35. A method for monitoring damage to an optical element of a laser resonator, the
2 method comprising:

3 shining a light beam onto a surface of the optical element;
4 detecting an intensity of a reflected portion of the light beam that is reflected by the
5 optical element; and
6 comparing the intensity of the reflected portion of the light beam with a reference
7 intensity.

1 36. The method of claim 35, wherein the light beam is directed to the surface of the
2 optical element at an angle of greater than 60° to the normal of the surface of the optical
3 element.

1 37. The method of claim 35, further comprising generating an error signal when the
2 intensity of the reflected portion of the light beam differs from the reference intensity by a
3 defined value.

1 38. The method of claim 37, further comprising switching off a laser in response to the
2 error signal.

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